An Approach to Risk Characterization – USACE Dam and Levee Safety Programs

Presentation for Flood Risk Management Workshop

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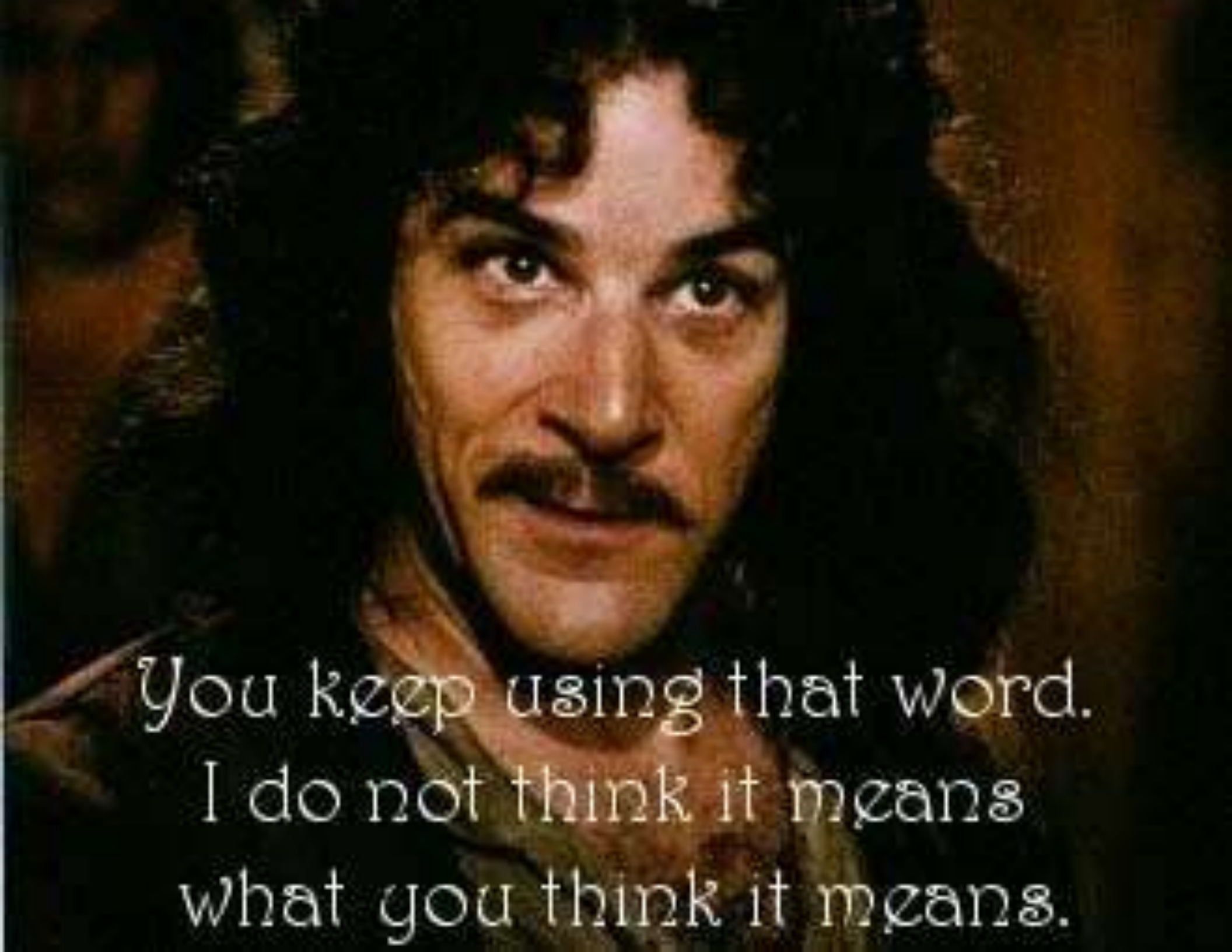
US Army Corps of Engineers

BUILDING STRONG®

Discussion Outline

- Bottom Line Up Front
- Relevant Facts About Risk Characterization in the Dam and Levee Safety Program
- What We've Learned As Infrastructure Owners and Leaders


You keep using that word.
I do not think it means
what you think it means.

Bottom Line Up Front

- Consistent Risk Characterization has Been Critical to Safety Programs:
  - ▶ More Effective Communication:
    - Understand the Risks and Benefits
  - ▶ Improved Decision Making:
    - Enables Portfolio Management
    - Facilitates Smartest Options to Cost Effectively Reduce Project Risks

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DAM AND LEVEE SAFETY PROGRAM KEY FACTS

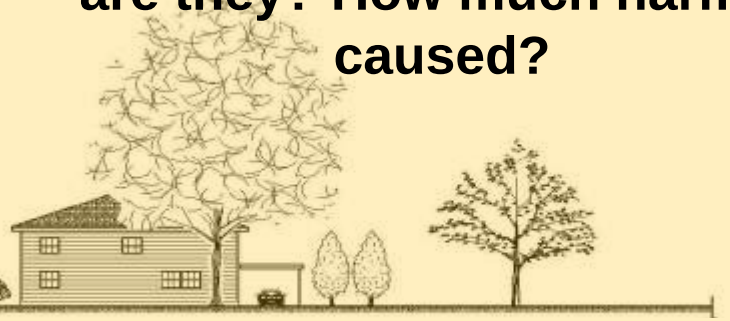
Risk Informed View of Infrastructure Safety

Risk = f(Hazard, Performance, Consequences)

What are the hazards and how likely are they to occur?

How will the infrastructure perform in the face of these hazards?

Who and what are in harms way? How susceptible to harm are they? How much harm is caused?



Infrastructure Safety Program: Focused on People, Performance, and Risks

TABLE 3.1 – USACE DAM SAFETY ACTION CLASSIFICATION TABLE* 12 February 2013

URGENCY OF ACTION	ACTIONS FOR DAMS IN THIS CLASS	CHARACTERISTICS OF THIS CLASS
VERY HIGH (1)	Take immediate action to avoid failure. Communicate findings to sponsor, local, state, Federal, Tribal officials, and the public. Implement interim risk reduction measures, including operational restrictions. Ensure the emergency action plan is current and functionally tested for initiating event. Conduct heightened monitoring and evaluation. Expedite investigations to support remediation using all resources and funding necessary. Initiate intensive [illegible] and actual support	CRITICALLY NEAR FAILURE: Progression toward failure is confirmed to be taking place under normal operations. Dam is almost certain to fail under normal operations within a few years without intervention. OR VERY HIGH INCREMENTAL RISK**: Combination of life or economic consequences with likelihood of failure is very high. USA[illegible] extraordinary circumstances.
HIGH (2)	Communicate findings to sponsor, local, state, Federal, Tribal officials, and the public. Implement interim risk reduction measures, including operational restrictions as justified. Ensure the emergency action plan is current and functionally tested for initiating event. Conduct heightened monitoring and evaluation. Expedite confirmation of classification. Give very high priority for investigations to support justification for remediation.	FAILURE INITIATION FORESEEN for confirmed and unconfirmed dam safety issues, failure is likely during normal operations or be initiated as the consequence of an event. The likelihood of failure from one of these occurrences, prior to remediation, is too high to assure public-safety. OR HIGH INCREMENTAL RISK**: The combination of life or economic consequences with likelihood of failure is high. USACE [illegible] extraordinary circumstances.
MODERATE (3)	Communicate findings to sponsor, local, state, Federal, Tribal officials, and the public. Implement interim risk reduction measures, including operational restrictions as justified. Ensure the emergency action plan is current and functionally tested for initiating event. Conduct heightened monitoring and evaluation. Prioritize investigations to support justification for remediation informed by consequences and other factors.	MODERATE INCREASED RISK: For confirmed and unconfirmed dam safety issues, the combination of life, economic, or environmental consequences with likelihood of failure is moderate. USACE considers this level of risk [illegible] acceptable except in unusual circumstances.
LOW (4)	Communicate findings to sponsor, local, state, Federal, Tribal officials, and the public. Conduct elevated monitoring and evaluation. Give normal priority to investigations to validate classification, but do not plan for risk reduction measures at this time.	LOW INCREMENTAL RISK**: For confirmed and unconfirmed dam safety issues, the combination of life, economic, or environmental consequences with likelihood of failure is low and the dam may not meet all essential USACE guidelines. USACE considers this level of life-risk to be in the range of tolerability but the dam does not meet all essential USACE guidelines.
NORMAL (5)	Continue routine dam safety activities and normal operations, maintenance, monitoring, and evaluation.	VERY LOW INCREMENTAL RISK**: The combination of life, economic, or environmental consequences with likelihood of failure is very low and the dam meets all essential USACE guidelines. USACE considers this level of life-safety risk to be tolerable.

*At any time for specific events a dam, from any action class, can become an emergency requiring activation of the emergency plan.
** INCREMENTAL RISK is the risk that exists due to the presence of the dam and this is the risk used to inform the decision on the DSAC assignment. The information presented in this table does not reflect the NON-BREACH RISK associated with the presence of the dam or from operation of the dam.

Avoid Numbers

What Can Be Done About the Risks?

What Does this Mean for the Community?

What is the Source of the Risks?

Compared to Others, How Significant is the Risks?

Principles for Characterizing Infrastructure Risks…

- On a Portfolio Basis:
  - Consistent
  - Defendable Process
  - Relativity of Results
  - Be conservative in face of uncertainty
  - Which Risks?
    - Incremental Above Flood Risk
    - Non-Breach Flood Risk

Principles for Characterizing Infrastructure Risks…

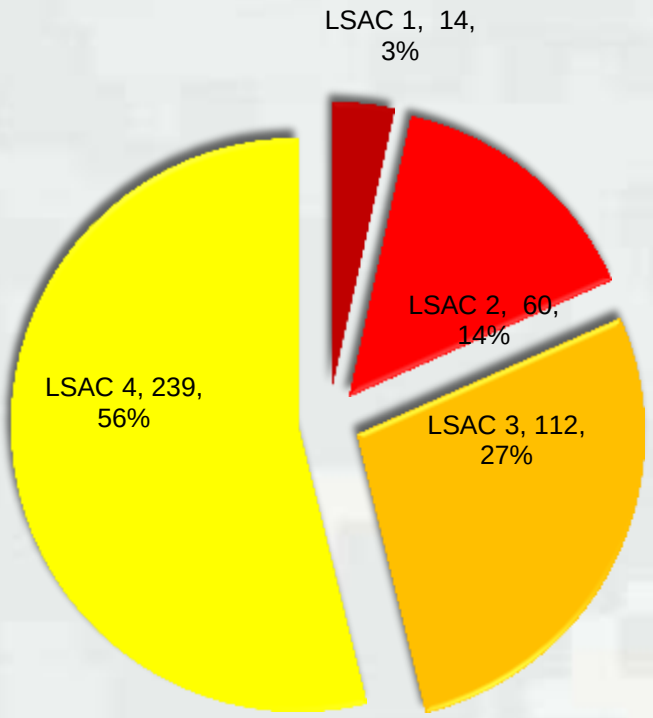
- On a Project or Systems Basis:
  - ▶ Concise Problem Statements
    - Source of Risk
  - ▶ Justification for Action, Priority and Urgency
    - Short Term (Interim)
    - Long Term
  - ▶ Defendable Decisions and Investments

Risk Prioritization Metrics

1. DSAC or LSAC
2. Cost to Save a Statistical Life
3. Severity Matrix Category
4. Incremental Annualized Life Loss
5. Annualized Probability of Failure
6. Annualized Incremental Economic Damage
7. Total Direct Damages
8. B/C Ratio
9. Unique Considerations

Characterizing Levees within Our Authorities

Levee Portfolio - LSAC

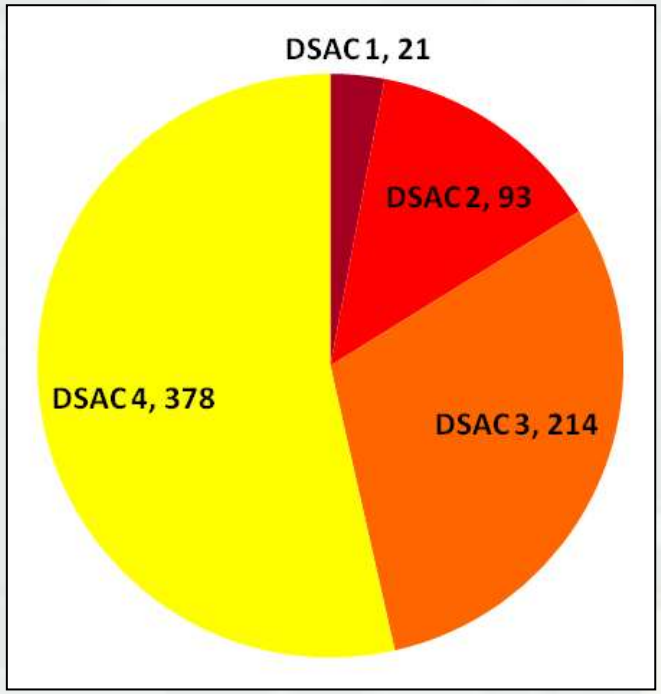


95% Earthen Structures
5% Floodwalls

- Huge Footprint on Society
- Half Actionable from Risk Perspective
- Main Risk Drivers:
  - Seepage & Piping
  - Overtopping
  - Culverts
  - Consequences
- Challenge: Shared Responsibility

Characterizing Dams We own

Dam Portfolio: DSAC

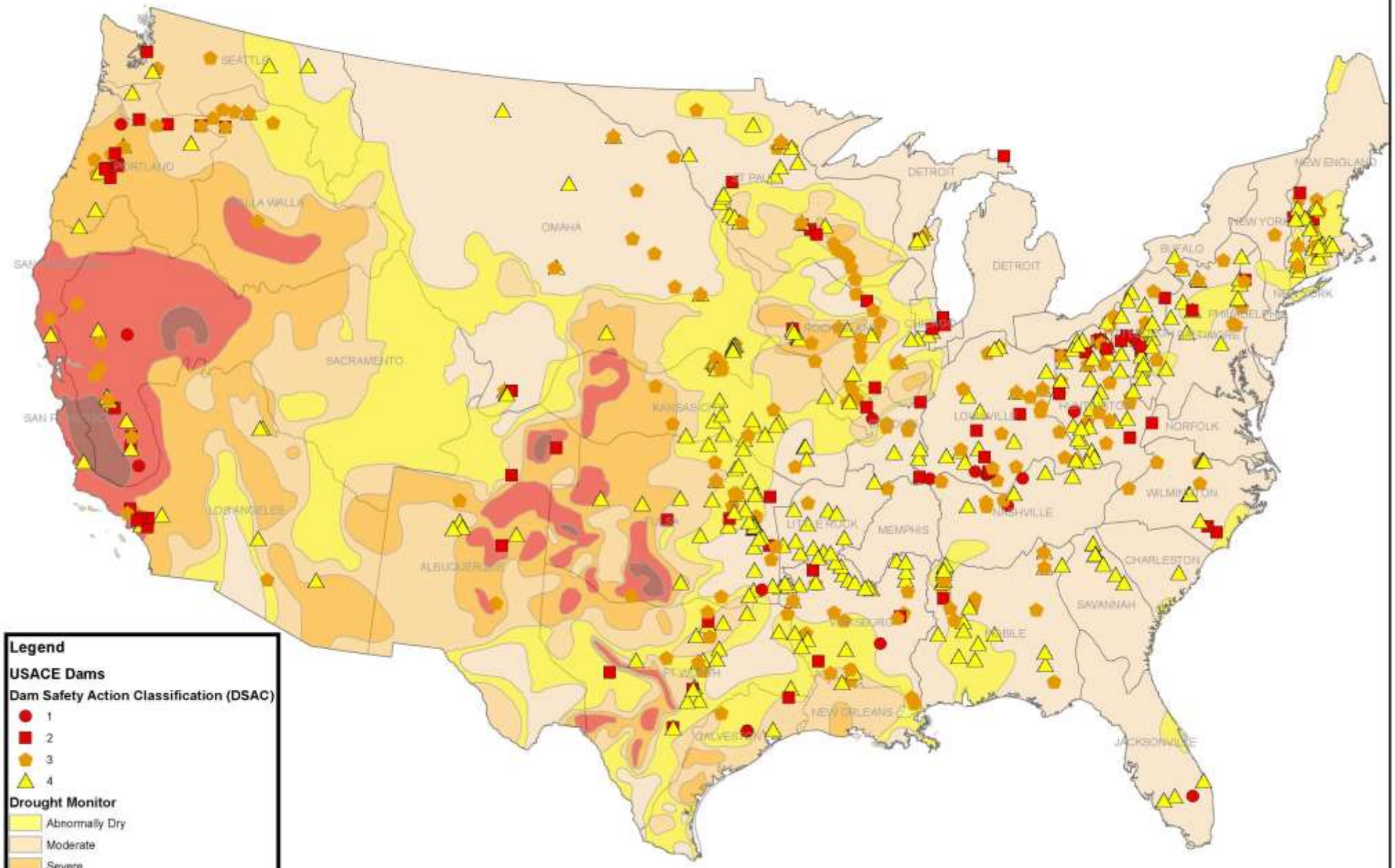


80% Earthen Structures
20% Concrete Structures

- 50% Federal Portfolio
- Nearly Half Actionable from Risk Perspective
- Main Risk Drivers:
  - Seepage and Piping
  - Flood Risks
  - Consequences
- Challenge: Water Supply Reallocations and Unsafe Dams

USACE Dams with Risk Characterization

Drought Layer Current for Feb. 04 2014



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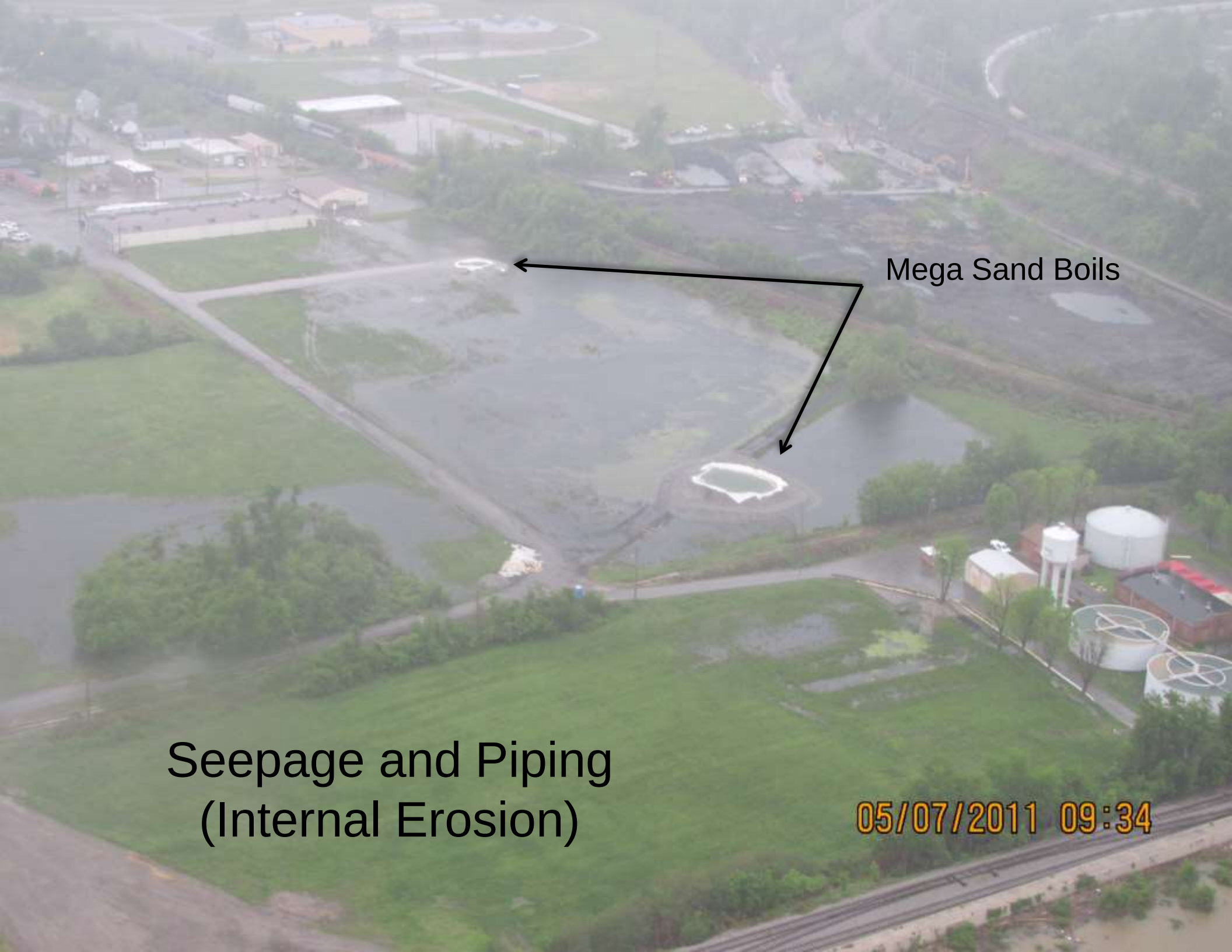
Date Created: Feb. 07, 2014



Seepage and Piping (Internal Erosion)


Overtopping


Consequence Growth


Inconceivable!

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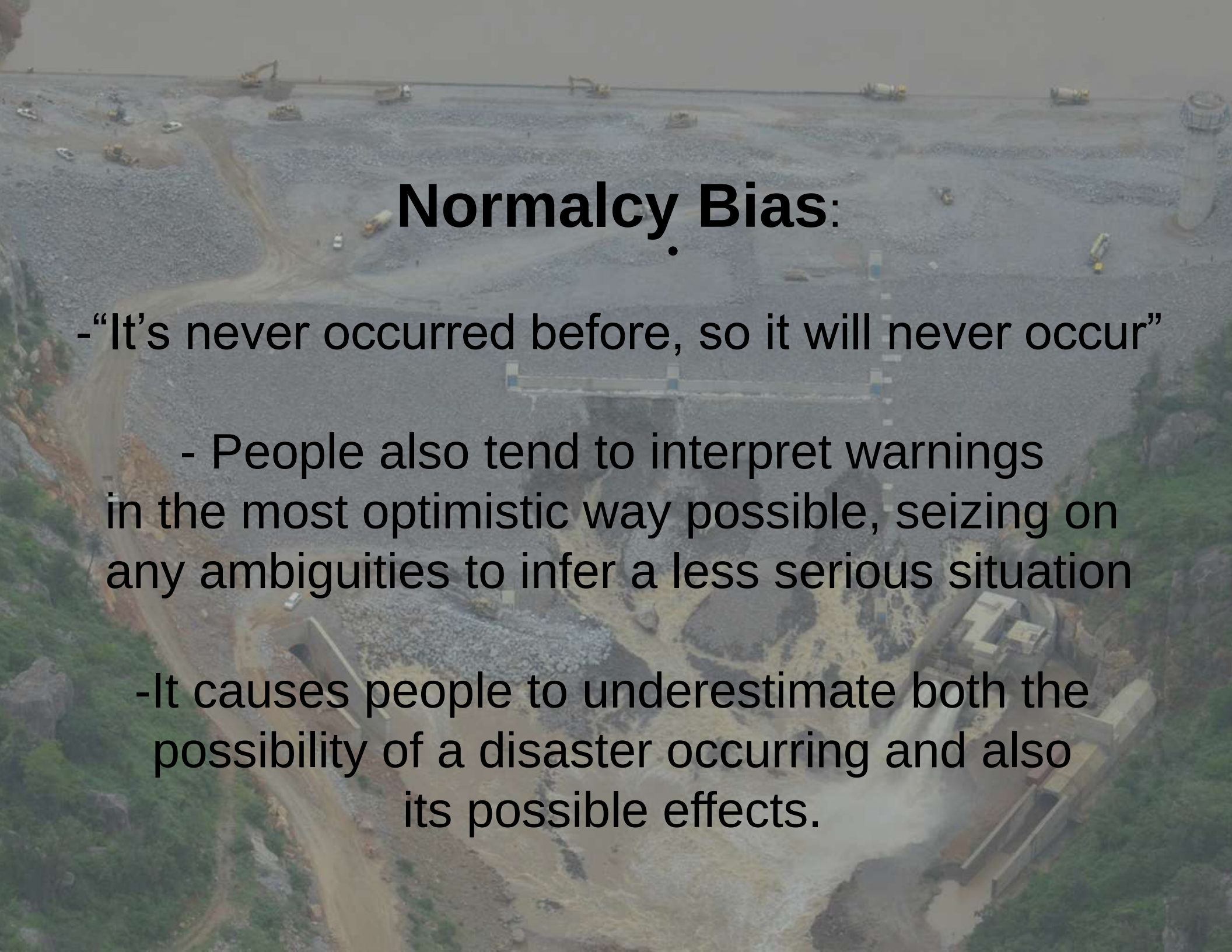
WHAT WE'VE LEARNED AS OWNERS AND LEADERS


Tokwe-Mukorsi Dam
Zimbabwe



Normalcy Bias:

-“It’s never occurred before, so it will never occur”

- People also tend to interpret warnings in the most optimistic way possible, seizing on any ambiguities to infer a less serious situation

-It causes people to underestimate both the possibility of a disaster occurring and also its possible effects.

1. Engage Sponsors

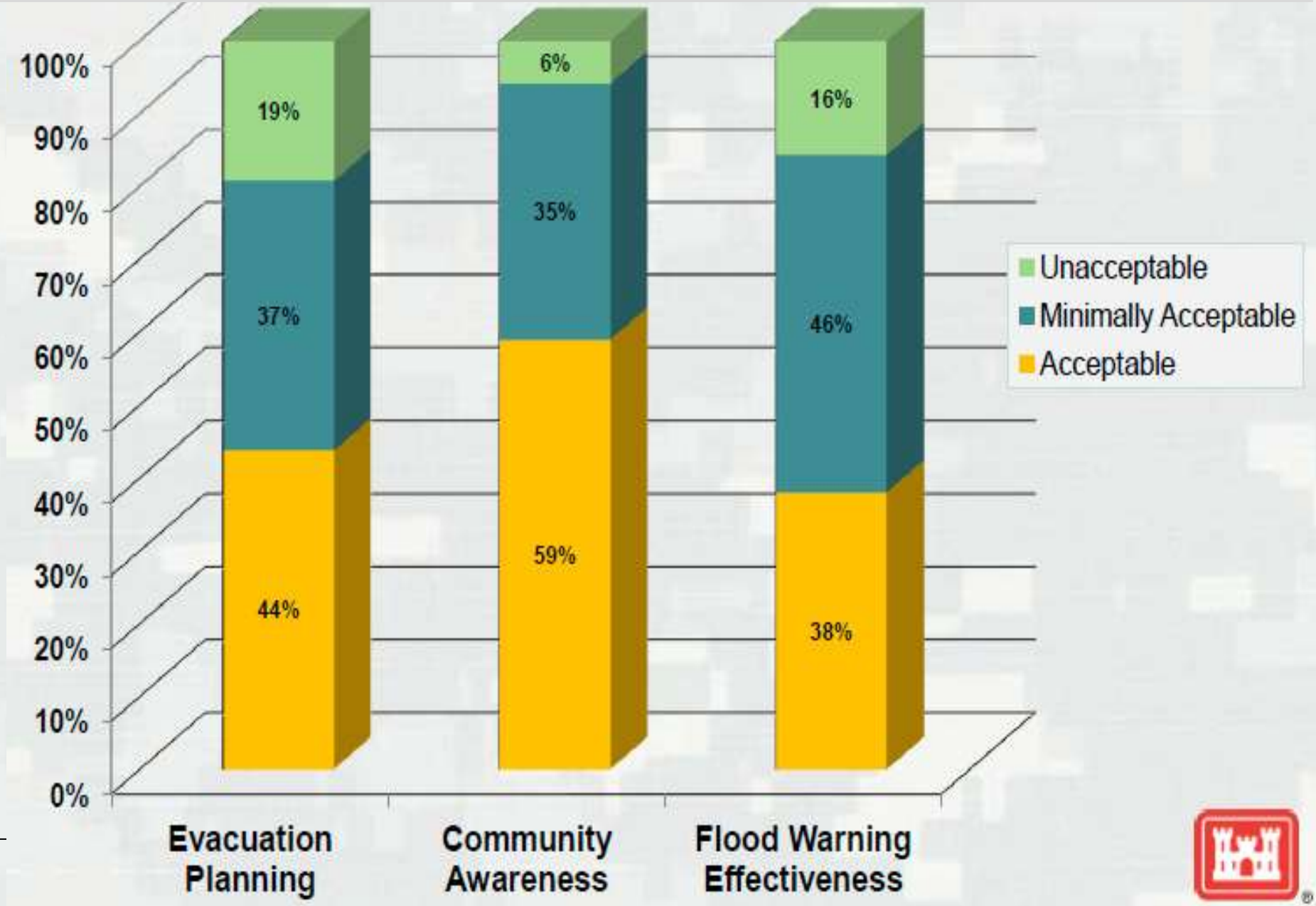
2. Communicate With and Through Sponsors…

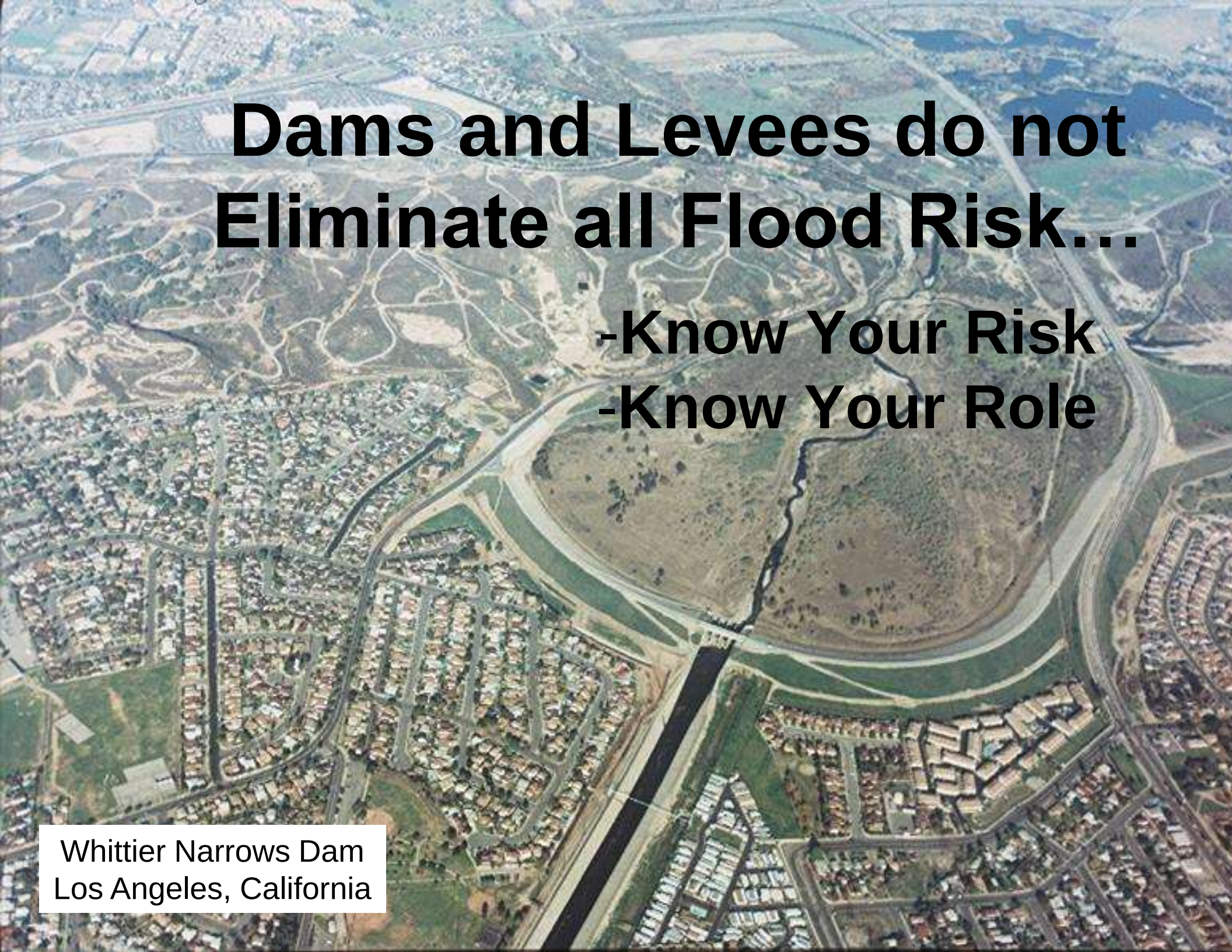
3. …to Communities


Risks…Show, Don't Tell…

Communities are Not All the Same

(Making Shared Responsibility Work)




Dams and Levees do not Eliminate all Flood Risk…
-Know Your Risk
-Know Your Role
Whittier Narrows Dam
Los Angeles, California

800 LB Gorilla is in the Room

- "If I could ask one thing of you, please…stop talking about risks"
  - Actual Comment from Sponsor for Corps Project
  - (and the unspoken wish of others…)

What are Tolerable Risks?

- Risks society is willing to live with as long as:
  - The Risks are Commensurate with the Benefits (see Civil Works video)
  - Risks are not negligible (see f-N chart)
  - There is a Responsible Owner on the Job
  - Risks are Reduced Further as Appropriate
    - Essential Engineering Guidelines
    - Cost Effectiveness
    - Other Measures

Discussion